MINISTRY OF SOCIAL WELFARE

JERUSALEM, ISRAEL

R E P O R T N O. 4

PSYCHO-SOCIAL ASPECTS OF RESEARCH ON REHABILITATION OF BLIND AND VISUALLY HANDICAPPED IN OPERATING IBM PUNCH-CARD MACHINES

B y

Yehuda Schiff & Shlomit Haiman

Prepared under a grant from the Vocational Rehabilitation Administration, Department of Health, Education and Welfare, Washington D.C., U.S.A.

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Jerusalem, April 1966

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In cooperation with

The Office Mechanisation Centre
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The Jewish Institute for the Blind

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F O R E W O R D

The Ministry of Social Welfare of the State of Israel proudly presents the Fourth Report on the Psychosocial aspect of the research and demonstration project on Rehabilitation of Blind, Partially-Sighted and Otherwise Handicapped Persons as Data Processing Machine Operators (VRA-ISR-13-64).

This is one of a series of demonstration and research projects in vocational rehabilitation financed by P.L.480 through the Vocational Rehabilitation Administration of the Department of Health, Education and Welfare of the United States Government.

He who reads through the reports on this project as well as through the reports on the three projects which have already been concluded and published* will find that in the area of vocational rehabilitation in general, and especially in the rehabilitation of the blind, a slogan can be borrowed from the U.S. Marine Corps: 'The difficult we do immediately, the impossible takes a little longer'.

The successful employment of 20 graduates as D.P.M. operators and computer programmers is in itself a most rewarding result of the project and encourages all who participate in this enterprise to go on towards harnessing the

most modern technological developments to the project's goal.

The extension of the project over another two years is a tribute to the accomplishments of the project team, IBM-ISRAEL, O.M.C., The Jewish Institute for the Blind - and last but not least, the trainees themselves.

MA Kurtz

Dr. M.A. Kurtz
Director-General
Ministry of Social Welfare

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*1. Evaluation of the Results of the Training of the Blind in Cotton Yarn Winding, published by the Ministry of Social Welfare and Israel Institute of Productivity, 1964.

2. Research on Training of Blind in Yarn Winding, published by the Ministry of Social Welfare and the Israel Institute of Productivity, 1965.

3. Survey, Examination of the Prospects for Placing the Blind in the Weaving Industry as Knotting and Tying-in Operators, published by the Israel Institute of Productivity, 1965.

INTRODUCTION

The aim of this project is to study the possibility of providing a rehabilitation programme for the training of the blind as IBM operators, in order to propose an institutionalised programme of this type. This will be accomplished by a demonstration of the training procedures used at our centre.

The study has two aspects, the professional-technical and the psycho-social. The former is in the hands of experts in the spheres of production and efficiency engineering, operator training and the problems of the professional training of the blind. Their goal is to determine the optimal training methods, and to adapt means of orientation and auxiliary instruments for the blind and partially-sighted. (Reports Nos. 1, 2 and 3 deal with this aspect).

With regard to the second aspect* - the psycho-social - we intend to determine, to the extent that this is possible, the social and personal conditions that guarantee maximal success to the rehabilitation programme. This report refers to this aspect and in it we will try to describe and define aims and purposes. Some vocational specialists for the blind have come to the conclusion that training given to blind trainees under the same conditions and with the same type of instruction and equipment as that given to sighted students has produced the best results.

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*See Paragraph 4, "Research Goals", Report No. 1

Our short experience in the IBM field has not verified this point of view, which is probably correct for other kinds of training. Although we may use the same teaching programme, the methods must be different. Since the blind have never worked in IBM systems we are compelled to seek systematic, standardised means that will enable us to select the most promising candidates. We therefore are trying to develop standards for blind IBM trainees suited to the special teaching system and to the special performance techniques. This is an accepted practice for many jobs and is even more valid for work with the blind.

Standards used in assessing values of physique and physical appearance often are quite arbitrary. The armed services, for example, have set minimum height and weight standards for induction. Physical health standards also must be met by the inductee.

Until tests will have been developed we, too, set arbitrary standards, e.g. the candidate must have an above average level of intelligence, secondary education, knowledge of English, understanding of basic Algebra, etc.

Information of this type we have from other sources preceding the course. This includes general information on personality, life-history, educational background, state of health, etc. Each of the candidates for our course undergoes a medical test by a general practitioner and an eye specialist. We also had

at our disposal results of personality and intelligence tests. However, in addition, we require more specific information relevant to our purpose. The problems which we want to discuss do not apply to the accepted tests, but to additional ones which are specific to work with IBM machines.

Professional decisions depend on many things, including opportunity, interest and a variety of fortuitous circumstances, but among the most important determinants should be evaluation of abilities, aptitudes and capacities.

The judgment of capacity requires information about a potential, about a characteristic that cannot be seen, but ability and aptitude refer to what a person can do at present, not what he will do. Therefore, apart from these tests, the first 6-8 weeks of the programme are considered as a period of evaluation while he is adjusting to the new environment, and new kind of work.

On the one hand, the IBM operator is engaged in physical work to the extent that he has to stand on his feet for 8 hours a day and has to lift boxes of cards in order to feed the machines, and has to remove cards from the machine and arrange them in their designated place. On the other hand, he also engages in the difficult abstract work of panel wiring, which requires concentration. This is done outside the machine room.

As a result of this combination, we must require that the candidates be in a satisfactory physical condition, have a high

level of intelligence, have sufficient education to enable him to read professional literature in a foreign language and other aptitudes. (It should be noted that the language problem would not apply in English-, French- and/or German-speaking countries, since the IBM literature can be obtained in these languages).

An additional problem is the "hearing" of the trainee. An operator spends most of his working day in the machine room where there is a considerable amount of noise. For the blind operator it is extremely important that his sense of hearing be highly developed. This enables him to distinguish correct and faulty operations of the machine, which the sighted operator normally discerns by vision.

Efficiency of hearing can be observed directly by noting how the trainee reacts to auditory stimuli. Although we have not implemented this, we now feel that candidates should be tested with a pure tone audiometer to measure the adequacy with which they can hear different sound frequencies. Special tests are now available to determine not only the effectiveness with which a person can hear tones, as on an audiometer, but also the effectiveness with which he can hear and understand speech. This is necessary because the IBM operator sometimes receives instructions from the supervisor while he is working on the machines. Any misunderstanding due to abnormality of hearing might cause the blind operator to make

mistakes in the operation of the machine. We suggest that in any future courses of this type auditory ability should be one of the criteria of acceptance.

If we define abilities on the basis of different observed behaviour patterns in the evaluation period, then the number of abilities could be as great as the possible number of such behaviour patterns.

Experience in our vocational rehabilitative work with the blind has enabled us to make the necessary limitations to the number of abilities with which we concern ourselves.

One of the possible results of our study is the development of such special performance tests for blind IBM operators and computer programmers. However, the small number of blind trainees makes it difficult to develop dependable norms for these kinds of tests.

So far the discussion has enumerated the advantage of tests and has hinted at some of the disadvantages. Eventually, perhaps, tests will be devised to assist in the evaluation period. We have discussed this problem with various specialists in psychology and rehabilitation. We are particularly grateful to Dr. Yael Flum of The Hebrew University, Dr. William Gelman, Executive Director of the Jewish Vocational Service of Chicago, and Dr. Alexander Hulek, Chief of the Rehabilitation Unit of the United Nations, the last two of whom visited our Centre. On

their advice the criterion 'Success in the course' was and is determined in the following manner: after the first course was completed and the trainees placed, we tried to determine retrospectively which factors are common to those operators who were accepted by their employers and integrated into the new framework.

This is necessary because of the small numbers. Similarly, the small numbers and the above method necessitated the measurement of as many behaviour-units as possible.

It may be that we should use additional methods (possible ones are described later in the report). But a test situation is preferable since it can be more objective than a non-test situation, and prejudice on the part of the observer is easier to control when the observer is making use of standardized tests.

The psychologist has the responsibility of selecting tests which will best serve the purpose and the trainee. He should report the results so that they will make the maximum contribution to the total vocational evaluation. He should also have sufficient vocational rehabilitation orientation to make recommendations which will be useful in the training programme.

This report will not attempt to provide concrete proposals for the planning of a programme, since we are at a stage that does not allow for clear-cut proposals, and

certainly not final conclusions or decisions. We shall merely present the stages of the "institutionalisation" of the research, as expressed in the crystallization of our hypotheses about the factors involved in the success of the programme. The hypotheses, which at the beginning of our activities were built upon experience during the course itself and upon a number of preconceived ideas, became more specific with the advance of the study. We shall describe this development up to its present stage and try to clarify its various aspects.

Similarly, we will describe the methods we used to test our hypotheses at their various levels. In addition we shall enumerate the difficulties that we face in drawing conclusions, in the research methods available and in the criteria by which we determined the relevance of the various factors that required investigation. The problems involved in the research methodology are not only concrete, technical difficulties, but include the danger that our conclusions and proposals are liable to be incorrect because of methodological obstacles. Consequently, we shall deal with these difficulties from the point of view of the "research risk" which they entail, as well.

All the material in this report belongs to the psycho-social aspect of the research; and when we talk of "the study" or of "the research", we are referring to this aspect, unless otherwise stated.

1. THE FOCAL POINTS OF THE RESEARCH

A. The purpose and aims of the rehabilitation programme

As has already been stated, our purpose was to locate the factors that contribute to success in the training of the blind as operators, and the factors liable to hinder the success of the programme.

The aims we wished to realize were as follows:

1. The determination of the abilities and personal qualities that help the blind or partially sighted operator: a) during the course, and b) in the work period.

2. The determination of the social conditions, both technical and professional, that help the blind or partially sighted operator: a) during the course, and b) in the work period.

The final objective is first the recommendation of criteria for the selection of candidates to this type of course (for the planners of future courses), and secondly, the creation of conditions - to the extent that it is possible - for the success of the programme. By "creation of conditions" we mean the conditions within the frameworks of the course and of the work environment. In particular, training methods and the discovery of means of orientation (tactilization) on the one hand (as dealt with in Reports 1, 2 and 3), and the creation or discovery of social conditions that will guarantee the success of the programme by the acquisition of a profession and by the successful placement, on the other hand.

We can see that from the point of view of the rehabilitation programme, and research into it, there are two dimensions.

The first one centers on the period of the programme, so that we have THE TRAINING PERIOD as opposed to THE WORKING PERIOD.

The second dimension relates to the unit of manpower, giving us THE OPERATOR (the individual) as opposed to THE FRAMEWORK.

Manipulation of these two factors can be represented as follows:

The research unit

The Period	The Framework	The Individual
The Training Period	1	2
The Working Period	3	4

The "realization of the rehabilitation programme", as a general objective is to be viewed from four aspects:

1. The success of the individual in the training period.
2. The success of the training framework (the course for operators).
3. The success of the individual in the work of operation.
4. The establishment of a work framework for the blind in the IBM systems.

Each of these four manipulations of the dimensions of the rehabilitation programme for the blind serves as a secondary goal of our project and of the attempts to discover factors that will guarantee its attainment. If we were to introduce these variables to the table, we would have the following situation:

The research unit

The Period	The Individual	The Framework
The Training Period	1. The personal qualities that help the blind operator in learning the skills of operation.	2. Social conditions (technical and professional) that facilitate the organization of the course for operators.
The Working Period	3. Personal qualities of help to the blind operator in his work.	4. Social conditions, (technical and professional) that aid the blind operator's work and his introduction into the system.

Thus the success of each of the four aspects of our research is dependent on the optimation of its factors as listed in the same cell of the diagram.

B. The Institutionalization of the research

The first step in the research can be thought of as the translation of the abovementioned elements into dependent and independent variables, the relations between which could be investigated. "The success of the rehabilitation programme"

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

which is the central aim, is the dependent variable, and the four measures of it are sub-variables, which for the purposes of our research serve as four dependent variables.

The factors that guarantee the success of the programme are the independent variables of the study, and we purport to specify them by means of investigation of their connections with the relevant dependent variables. Eventually we shall present them as practical criteria for the acceptance of candidates, for the creation of work conditions, teaching methods, etc.

In the last chapter we shall describe the formalization of hypotheses concerning the independent variables, and the means of treating the latter.

As the hypotheses about the relevant independent variables became more formulated the research itself took on a more definite shape, and it became progressively easier to adapt it to a structured framework. Thus, the development of the psychosocial study cannot be seen as running parallel to the chronological events during the courses at our centre, but as running parallel to the degree of crystallization of our set of assumptions concerning the independent variables. This is true from the stage of the first course until the future final stage, when we hope to be able to point out independent variables with a reasonable degree of verification.

C. Data and information

1. The history of research into the training of blind operators:

At the beginning this was an attempt to rehabilitate a small number of people. It became apparent that the experiment was succeeding much more than had been expected and during the first course more or less institutionalized norms of the means of conveying the material were formulated. Indeed, a great deal of effort was expended in the creation of means of orientation and specific instruments for the work, which later proved their efficiency in the work systems in which the blind apprentices were placed.

Consequently it appeared worthwhile devoting additional efforts to the institutionalization of a programme of this nature which could be of paramount significance in the rehabilitation of the blind. Moreover, in this way future courses are prevented from becoming the subject of unplanned (and partisan) training.

At the time that it was decided to conduct the experiment for the purpose of drawing conclusions and determining norms about the programme, eight blind and semi-blind apprentices were being trained as IBM operators. At a later period in the research, eight additional pupils received training, while the first group was absorbed into various places of work.

The candidates reached the course via the Service for the

Blind of the Ministry of Social Welfare. The selection of the candidates for the course was made by the professional instructors for the operation of IBM machines and the supervisors of the Service for the Blind. For the first course the standards required of the pupils were very high, and most of those who were accepted had finished high school. (The level of intelligence was above average). Some of them were still of high-school age and some had already had some experience of various types of work and had proved their ability to fulfil the obligations of professional work.

The contribution of the first course to the research.

Since the level of the students of the first course was above average from many points of view there were maximal conditions for success. The chances were high that if they could successfully acquire the material and could be brought to independent control over the machines, it would be possible to fit them into the IBM installations as operators. Thus from the point of view of rehabilitation and placement possibilities, this group had excellent qualifications.

However, the students of the first group could not contribute to the discernment of the norms necessary for a criterion for selection, nor for the description of the required abilities and qualities. For these purposes it was necessary that there

be variance among the pupils in their education, abilities, acceptance of blindness and attitude to work, and on the remainder of the variables.

During the first course, which lasted a year, there were no systematic experiments in the psychological and social aspects of the research, and the advantages were purely technical. Since all the pupils were above the average intelligence of the sighted operator, consistency of the intelligence variables was guaranteed (e.g. it was obvious that none of the pupils would fail because of his educational background or because of his low intelligence). Consequently, these factors played a minimal part in the success of the individual. Under these conditions it was possible to formulate training methods and primary means of orientation during the studies and work of the pupils.

Since we aim to enable the planning of courses of this type, as institutionalized rehabilitation programmes, it is necessary to discover the specific qualities of the blind person that enable him to succeed in the course and at work as an operator. By means of description of the significant components, we shall be able to forego high requirements in all spheres (as was the case with the pupils of the first course, which was run while we were still unequipped with

sufficient knowledge) and this type of rehabilitation will be open to much broader strata of blind people.

The systematic investigation of these problems only began at the beginning of the second course.

2. The observation groups

For the purposes of our research we had at our disposal two groups of eight pupils, one of which was in the study period and the other in the work period.

All the pupils were blind or partially-sighted, being included in the definition of blindness accepted in Israel and most Western countries.

The two groups were heterogeneous on a number of criteria: country of origin - the pupils come from ten different countries; education - although we tried to maintain a minimum level of at least three years high school, there were those who had had less than this, and those who had studied abroad and whose educational "path" was somewhat different; age - on the whole this was between 18-25, but there were exceptions.

Similarly, there were great differences in the degree of blindness among the partially-sighted, and also in the causes and types of blindness as well as the age of becoming blind, among both the blind and the partially-sighted. There were differences in intelligence, professional ability, and social, economic and

familial situations. While there were differences in the type of education received, many of the group had attended a special primary school for the blind, the advantage of which could be seen in their skill at braille, their free movement and their adaptation to special work methods. Moreover, they had known each other from childhood, and formed a sort of "clique" within the total group. Among those who had high-school education, some had attended ordinary schools, while others had studied extraneously.

In the working group there were three girls and five boys, whereas in the study group there was only one girl and seven boys. Apart from two of the subjects who are married and have families, the rest of the 16 subjects are single.

With regard to the average levels of the two groups there was great disparity. As already mentioned, the first group was chosen for its educational and intellectual superiority and for its academic success. Not only was the average of the second group poorer than the first on the majority of the factors, but it was also more heterogeneous on factors such as age, work experience, professional inclination, etc. It seems, therefore, that the combination of the two groups is likely to afford more possibilities for hypotheses and inference, since the differences in level give us a larger distribution in the relevant factors of

the programme, and will no doubt aid in the determination of the connection between each of the variables and "success in the course".*

D. The present research as a pre-test

The present experiment is the first of its type in attempting to formulate a rehabilitation programme for the blind and partially-sighted as IBM operators. Consequently it should be regarded as explorative from the points of view of the newness of the material, the research methods and the small numbers used, and possibly because of the heterogeneity of the groups.

Thus the conclusions that we reach should be taken as proposals for the planning of additional courses of this type, which should also be run as research projects. However, at this stage we will avoid reaching any final conclusions since we still doubt our ability to investigate the importance of all the possible variables, as relevant factors in the success of the course.

From the point of view of approach to the problem, the study must be seen as a pre-test. From the beginning we used various methods of investigation concurrently in order to ensure maximum efficiency, on the assumption that some of them would be abandoned with progress.

*The distribution of the two groups is given in the appendices.

The use of statistics is minimal. To the extent that we have used them, they were mainly classification methods and not means of statistical inference, which is hardly possible because of the small numbers.

On the whole, the research methods were descriptive, including a follow-up of the pupils and graduates, unstructured case-notes on the subjects and the happennings of the course, and a comparison among the operators and between them and sighted operators. Thus our methodology was typical of the exploratory research.

Nevertheless, a number of clear tendencies, of specific direction, appeared from among the diversity of the material that we collected in a somewhat haphazard fashion. Occasionally it was obvious that a certain relevant factor to the success of the project acts indirectly. In such cases we treated it as being a possibly decisive, independent variable and tried to study it, at later stages, in a manner as structured and quantitative as possible. On the bases of factors of this nature, we were able, at more advanced stages of the research, to build a set of hypotheses concerning the independent variables.

To a great degree, the stages of the research are bound to the development of the specific hypothesis, and simultaneously to the general theory. On the other hand, the verification of

our hypotheses is dependent on the efficiency of the investigation techniques. The latter were not at a sufficiently high level during the primary stages, for the abovementioned reasons, and also because they must be suited to the variables under consideration and cannot be predetermined.

2. THE RESEARCH METHODS

A. The connection between the methodology and the stages in the institutionalization of the hypotheses:

As already mentioned, the methods used are connected to the degree to which the hypotheses are formulated. Certain research methods could not be used before the hypotheses were more or less specific and were consequently unavailable to us until a certain degree of crystallization had been attained.

However, this is a matter for consideration at more advanced stages. The first method, chronologically speaking, was entirely explorative in nature.

The procedures used can be divided into two categories:

1. Personal follow-up.
2. Extrapolation of the connections between the variables by means of graphs.

During the earliest stages we used procedure No. 1 only, employing a number of techniques which will be described later. The reason for this was that we still did not know exactly what we would be investigating.

It was only later on that we could use procedure No. 2 - once we were convinced that a specific variable merited detailed investigation as an independent variable - whilst continuing to make use of the first method.

B. The problem of determining a homogeneous procedure for the research.

The main source of difficulty in deciding which method should be used was a consequence of the aforementioned small number of subjects and their distribution. The latter was not normal, nor could it be expected to be in such a small sample. Moreover, the members of the first group had different characteristics from those of the members of the second group because of the selective choice of the candidates. Thus the sample was far from being random. This caused numerous problems, not only in the presentation of and inference from the material, but also in the determination of a single procedure. It was impossible to regard the two groups as a single sample, and yet they were too small to be taken as two samples.

Furthermore, the first group was already at the work stage when the statistical analysis was begun, and this too made it unfeasible to use one method for both groups even in those spheres where this was possible on principle.

Finally we used two main procedures simultaneously, and tried to suit each of them (to the extent that this was possible) to both of the groups.

C. The personal follow-up.

The most accepted means of study for this number of people is the "Case Study". But of course this was possible mainly for the second group, for the continuous information on the first group had been "lost", and only certain techniques were applicable: the collection of data retroactively, etc.

Supervisors' evaluation: A continuous watch was maintained on each subject during the period of his studies, and a record kept of his progress in practical work and in theory. Initially progress was decided on the basis of the evaluation of the course instructors, and that of the supervisors in the machine rooms in which our graduates were working. After a while a more objective means of evaluation in the practical sphere was found.

The evaluation of the instructors and supervisors was freely "open". We intentionally did not limit them to specific criteria, for we hoped to extract the maximum information about related fields and abilities of which we had not originally thought, and which were likely at some later stage to be relevant independent variables. More than once, "special remarks" in one of these assessments turned our attention to unforeseen

factors of success. A case study was kept on each of the students of the study group with regard to the events of the course.* In this way, despite the scarcity of information and the few observations, we hoped to be able to specify the significance of different variables.

Some of the material of this type was drawn from staff meetings at which we discussed each individual pupil.

Since the members of the first group were scattered among the IBM installations throughout the country, it was difficult to accomplish a continuous follow-up of each one in his place of work. Consequently, the report of their development after they had been absorbed in the work system and the inspection of the special problems which arose out of their lack of sight, were accomplished by collecting their and their supervisors' opinions of their work in conversations and interviews.

Personal questionnaires and the interview were the means of collecting material in the early stages of the research. We compiled a questionnaire for the blind operators and for their supervisors. In order not to miss information about significant variables we tried to make the questionnaire as unstructured as possible (most of the questions were open).

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*The transition from machine to machine, changes in teaching methods, experience with a new means of orientation, etc.

Here as well we kept to our original system, i.e. using means that allow for the collection of the maximum information, including that which we had not previously thought of. This being the case, the questionnaire was presented in the form of a free conversation.*

The interview was the daily system of keeping record on the pupils during the course.

The collection of antecedent personal data: For both the groups personal details were obtained from the material that was available to us before the course, from the various educational institutions, from the Ministry of Social Welfare's Service for the Blind, and other sources. This material included everything that might possibly be considered as an independent or intervening variable at the very outset of the planning of the research. It contained information from formal personal details liable to influence the student's fitness for studies (country of origin, age, education etc.), to results of psychotechnic and personality tests, data on their previous work, their social relations, and so on. Throughout this collection of material, emphasis was placed on the condition of blindness, the typical difficulties specific to it, and its direct and indirect effect on each pupil.

*An example of the questionnaires for the blind operators and their supervisors can be found in the appendices.

During the study period the instructors were asked to record continuously, throughout the course, every detail that was relevant or seemed worthy of mention concerning the progress of the subject in his studies. This material serves as a dependent or independent variable in accordance with its content and its function for rehabilitation.

Personal achievement profiles: After the first institutionalization of the hypotheses, we started to use the method of personal profiles for a few of the students.

This was only possible once we had information about the pupil's progress over a number of months and in a number of the subjects studied. We recorded progress curves for each pupil from the instructors' assessments and from the objective marks obtained by test exercises* in those subjects where achievement could be measured. This obliged the instructors to rely more or less on the job analysis of an operator as analysed by us for the blind operator (Reports Nos. 1 and 2).

This system preceded the graphs and is closer to the case study, despite the fact that here we are concerned with specific independent variables.

The progress curve was analysed later in accordance with information about the pupil's personality. In the light of our

*See instruction report.

hypotheses about the independent variables of the subject's success, we attempted to study the consistent phenomena that appeared in the progress of each student in order to obtain indicators of possible concrete hypotheses.

D. Extrapolation of the connections between the variables by means of graphs.

At a more advanced stage in the research, after we had a better conception of the variables, we tried to assess the influence of some of them on the relevant dependent variable. The system is a sort of combination of analysis of events and graphical means of correlation. This can only be done with those variables that are given to quantification or can at least be arranged on an ordinal scale.

In principle this system is similar to examination of correlation coefficients; where one of the variables is "success in the course" or one of its aspects depending on what we are interested in investigating; and the second variable is one of those which we consider independent, can be arranged ordinally, and is relevant to the aspect of the dependent variable under consideration.

Obviously the working out of correlations is somewhat tentative because of the small number of observations (each group must be taken separately and contains only 8 subjects).

However, by graphical means we tried to understand the general lines of connection between the dependent and independent variables:

a) By inspection of the graphical connection between the independent variables and some aspect of "success in the course".

b) By means of analysing those cases that deviated from the expected.

In taking the graphical map as an indication of the existence of direct or inverse relationship according to our assumptions, we shall take into consideration that because of the small number of cases, only small deviations can be tolerated.

Analysis of each case of deviation is made possible by the general and detailed information we have on each individual. Indeed, the analysis departed from the routine of the calculation of correlations and made use of material from the case study. Often the most interesting generalisations, which are well worthy of further attention, in the future stages of the research, were discovered in this fashion.

Inspection of the cases of deviation was also carried out in the light of our assumptions. And so on the basis of these

inspections, with the addition of independent variables, we completed our system of hypotheses. In the continuation of this paper we shall be able to give graphical representations of some of the variables, and part of the individual curves with the conclusions that can be drawn from them.

E. Assessment by workmates.

For the criterion of the dependent variables - success of the student or operator in training and in placement - we considered the possibility of making use of the assessment of work-and study companions. This system is considered quite acceptable nowadays. However, because of reasons connected with the social atmosphere of the course and of the workmates, and because of the special sensitivity of the blind, this entails a difficulty which is over and above the normal social problems involved. If some way of deciding the average of companion-assessment in a manner that will not cause personal and group damage is discovered we will investigate it and try to integrate it into the assessment technique, either by means of a sociogram, or by means of "average opinion". Details of this will be presented in the summary report.

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3. SYSTEM OF HYPOTHESES

A. Criteria for classification of the variables

From the point of view of the possibilities of investigation, it is necessary to discuss a number of differentiations among the independent variables. A natural classification of the variables is in categories according to their content, e.g. the individual, social and technical factors, and so on. However, this division is on the level of the topic, and we are interested in a discrimination among the variables on a basis of the degree of their applicability to inspection, since this is the aspect which determines our ability to achieve some degree of verification of the hypotheses. On this level it is worth noting the following discriminations.

a) Variables under our control as opposed to those that are not. There are variables which we can create (e.g. multisensory aids), and those whose existence we can prevent, or whose influence can be partially or completely eliminated. Of course, this is extremely important for drawing conclusions from consequent changes in "the success of the project".

b) Variables that can be isolated as opposed to those that cannot. Of course, the importance of this classification is in the ability to distinguish, precisely, the true effect

on the dependent variable of the independent variable considered. For example, the variable "education" affects the pupil's degree of success, but not all the subjects studied in school are of consequence in the operator's course. Thus it is difficult to isolate education in the specific sphere relevant to the research. His general education is formally measured by the number of grades he has completed, and consequently it is often awkward to distinguish which of the sub-variables of "education" influence the pupil's success.

c) Variables that can be <u>examined quantitatively</u> as opposed to those that cannot. It is also important to distinguish those variables which, although they cannot be inspected quantitatively, can be arranged on ordinal scale. The variables in our research are mainly of this type.

To a very large degree, research methodology is conditioned by the above distinctions, and often the exactness of findings depends on them.

B. <u>Ways of treating the variables.</u>

It is our opinion that each of the independent variables which we will consider has some effect on the dependent variable, be it direct or indirect. We can safely say that in general the <u>two</u> categories on the <u>individual</u> plane, i.e. personal data functional to the success of the operator in 1) the training

period and 2) the work period, are homogeneous and encompass the whole category of personal variables. Those variables which were dependent on the framework were grouped into two separate categories: 1) the training period; 2) the work period.

In the second stage of the research we postulated hypotheses on the nature and influence of these variables and attempted to investigate them with different research methods.

At the end of the research, our proposals for the rehabilitation programme will be based on those variables whose effect on the success of the programme will have been verified.

The treatment of these variables is not identical. Some of them will be tested directly with the dependent variable. Others will serve as criteria and documentation for the analysis of events and development without inspecting their direct connection with "success" quantitatively or by way of structured comparison.

C. The Categories

(1) Personal variables in the training and work periods.

a) Formal personal variables.

1. The age of the students: Our assumption was that there exists an optimal range of ages at which the blind are likely to succeed in the training for operators and in adaptation to work. The desirable age range is from 17-30 (and occasionally

a couple of years above this), and within this framework the older the subject, the better are his chances of success. It is obvious that age itself has little importance and its effect results from the fact that many intervening variables are a function of it. Examples of this are responsibility, flexibility, experience etc. However, since we could not refer to each one of these variables individually (some are dealt with in other categories), and since we cannot be sure of encompassing all of them, we took age as an independent variable.

2. Education: Our hypothesis here was that high-school education, particularly in the sciences and mathematics, or professional-technical education, is advantageous to the operator's chances of success in training and at work.

3. Country of origin: As is the case in other spheres, we consider the effect of this variable to be indirect, and to be derived from in termediate variables which are difficult to isolate, e.g. knowledge of the language, accommodation to the Israeli way of life, and education to work, values, achievement etc. Some of these variables will also be treated separately in other places but we shall regard this variable as a complete unit. We consider that the probability of success of those subjects born in Israel, or those who received their education here, is higher.

4. Marital status: We propose that married subjects and those with families will be more successful than single subjects, since this variable provides genuine pressure and effects the motivation for work.

5. Economic conditions: We assume that there is an optimal economic situation for the success of the blind in study and at work, and this we propose, is in the middle of the range. Difficult economic conditions disturb the pupil in applying himself to his studies. On the other hand, a good financial status is liable to lower the principal motivation for economic and vocational rehabilitation, and without real pressure of this type, study is hindered and placement liable to be hampered.

6. Knowledge of Hebrew (measured by year of immigration): This variable is essential to adaptation to the work environment. For the blind person language has a more important rôle than for the sighted, since speech is almost his sole means of communication with strangers. In the study period, knowledge of Hebrew is necessary for the assimilation of the theoretical material and the instruction. Thus, the more fluent he is in the language, the greater the subject's chances of success.

7. Knowledge of English is essential for the mastery of the professional literature, which is mainly in that language. Thus the hypothesis is identical to that of Item 6 above.

8. Proficiency in Braille: During the course this variable helps the subject, since all the subject matter is transcribed into braille at our centre. However, it is not relevant to the partially sighted who, with the aid of special devices can read black print. With regard to the partially sighted who are not able to do this, the study of braille is a severe psychological problem. The reason for this is that although they require braille in the perspective of the future, they are unable to control the internal opposition to braille, which is considered the symbol of blindness. In cases where there are psychological complications the attempt to teach the partially sighted is liable to do more harm than good. Consequently, it is impossible to state the hypothesis on this variable without referring to the individual case and his personality. It can be said that among the totally blind (who have adapted to their situation), knowledge of braille ensures a greater degree of success.

b) Other personal variables.

1. Physique: Physical features such as height and strength affect the ability of an operator at his work. This is also true for sighted operators. It is known, for example, that females have less chance of succeeding at the job because the work occasionally involves a physical effort of which they are not capable. As with the rest of the variables, we think that the importance of this one is greater for the blind, since

suitable physique may compensate for the difficulties arising from their blindness.

2. State of health: Disorders in the operator's health, additional handicaps, or a general weak state of health are liable to reduce work ability. The reasons for the importance of the variable, and its specific importance for the blind operators, have been enumerated in the preceding paragraph. The healthier the subject, the greater his chances of success.

3. State of blindness: From the outset it was realised that this variable is of primary importance. Analysis of it indicates that it is essential to relate to its different aspects in order to understand the influence it exerts on the success of the pupils.

One must distinguish between the effect of blindness from the point of view of the psychology of the student-operator and its immediate concrete effects.

The variable is compiled of many sub-variables, of which the following will be investigated: a) degree of blindness; b) type of blindness; c) age of becoming blind; d) acceptance of blindness; e) the conditions of becoming blind. We know of the existence of additional sub-variables which we have at present not defined. Each of the abovementioned components must be considered as an important independent variable because of its considerable effect. Moreover, each of them is liable

to exert a different influence on each person when it acts in different configurations.

The concrete effect of the degree of blindness is different from the psychological one and it is difficult to propose a general hypothesis about these variables without analysing each person individually, while taking into consideration other personality factors and manipulations of the variable in question. In order to clarify this point, one might assume superficially that the more severe the state of blindness, the greater the difficulty in mastering the material and adapting to the work. However, the opposite is also true. For variables such as acceptance of blindness or knowledge of braille are intervening variables in this instance. The latter often vary directly with the severity of blindness, thus reversing the situation.

Because of the aforementioned differences between psychological and concrete effects of blindness, the same is true of the distinction between the partially sighted and the totally blind, and one cannot hypothesise a one-direction effect. Thus, despite the more complete lack of orientation, a person totally blind from birth is liable to succeed at a profession more than a partially sighted person for the reason that the former has accepted his situation more readily. One cannot know which variable will be more important in the

success of each individual in vocational rehabilitation.

For methodological reasons we attempted to approach the physiological and psychological aspects of blindness separately. We shall start with the former. From the physiological point of view, one can indicate a number of distinctions, each of which is probably an independent variable of success in the course and at work. The interaction between them is also liable to affect the direction.

(a) The degree of blindness: This was not measured ophthalmologically. Instead, for our purposes a crude distinction was made between light partial sightedness, where the subject is capable of reading black type (with or without the aid of special instruments), through the more severe stages of the handicap to absolute blindness. One can predict that the lighter the partial sightedness, the less negative will be its effect. However, we found that this is so only within a certain range. More specifically, among the partially sighted who are capable of reading black type, the generalisation has a high probability of verification. But this is not so for the more severely afflicted. Among those who cannot read black type, the lighter degree of partial sightedness does not always aid success, for they have not acquired the skills that would help them overcome the handicap. We noticed that the totally blind fared better in comparison to those operators

who have marginal remnants of sight. The source of this is quite obviously in intervening variables, mainly psychological, and in variables such as imagination, the sense of touch, etc. Moreover, one cannot regard the sub-variable "degree of blindness" in general without taking into account its interaction with other aspects of the total variable (state of blindness).

(b) Type of blindness: Is the degree of blindness static or progressive? This question determines the adaptation of the blind person to situations in general, and to the profession in particular. The effect of this variable is psychological. From a mental point of view, and from the point of view of technique, activity and communication, we forecast that the condition of static partial-sightedness facilitates the success of the subject, whereas the progressive state hinders him.* The situation of the partially blind person in whom the handicap is becoming progressively worse is more severe than that of the static, who has had more opportunity to adapt to the situation.

In setting our hypothesis about the chances of success of the pupil-operator as a result of the combination of the independent variables "degree of blindness" and "type of blindness", we will assume that static partial blindness permits relatively greater (concrete) success in the profession of

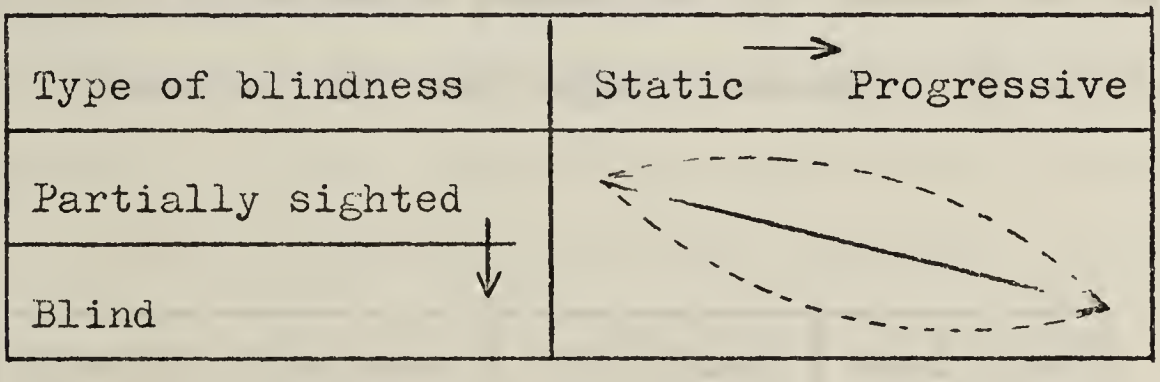
*We cannot go into the effect of all the suggested intermediary variables. Instead, in the analysis of the various situations, we looked for an explanation of success or failure in this variable.

machine operator. In contrast, almost complete blindness in a progressive process hinders success.* This can be designated as follows:-

Type of blindness	Static	Progressive
Partially sighted	a	b
Blind**	b	c

where "a" indicates the greatest probability of success in the course and at work, and "c" the lowest degree. The degrees between these two tend to fluctuate because of many intervening variables and consequently we have assessed them in a single category "b", which is merely smaller than "a" and greater than "c" despite the fact that range is much wider.

The tendency can be shown as:



where the arrows indicate reduction of chances of success.

(c) The age of becoming blind: We predict that the older the person was at the time of his becoming blind, the greater

*We wish to reiterate that in this analysis we are disregarding the psychological effect of the variables.

**The intention is absolute blindness or some close degree.

will be his difficulty in study and at work. This, too, is because of intermediate variables such as: acceptance of blindness, sense of orientation, knowledge of braille etc. Here we also desisted from formulating an absolute hypothesis without considering interaction of other aspects of blindness.

Our hypothesis about the chances of success as an operator, as a result of the relationship between "degree of blindness" and "age of becoming blind" as independent variables can be represented in the following way:

Type of blindness	Childhood*	Adulthood
Partially sighted	a	b
Blind	b	c

The equivalent hypothesis regarding the connection between the "type of blindness" and the "age of becoming blind" is represented thus:

Type of blindness	Childhood	Adulthood
Static	a	b
Progressive	b	c

If we taken into consideration a number of aspects of the state of blindness together, one might predict that the chances of

*By Childhood we mean blindness that occurred at a pre-pubertal or early pubertal age.

success in the course as a result of this variable, are the following:

Type of blindness	From the age of	Static → Progressive	
Partially sighted	Childhood		a
↓	adulthood		b
Blind	childhood		b
	adulthood		c

Till now we have considered the "state of blindness" from the physiological (or concrete) point of view, whilst mentioning the spheres in which psychological factors are liable to have some effect.

However, it seems desirable to devote special attention to the psychological aspects of the "type of blindness", since this often reverses the hypotheses. For example, in contrast to what is predicted in the foregoing diagrams, we find quite often that absolutely blind people (generally from birth or early childhood) are more successful than the partially sighted, for reasons of performance adaptation that were touched upon above, and particularly for psychological reasons.

One must also take into consideration the "conditions of becoming blind" whose influence is principally psychological. The reason for this is that becoming totally blind or partially blind through injury, is liable to cause such a harsh trauma

that even if the handicap is light partial sightedness of a static nature, the chances of rehabilitation of the pupil-operator are liable to be of the lowest degree.

Because it is difficult to define it operatively, we did not reach a crystallised hypothesis about this variable. Consequently we only took it into consideration in the analysis of events, and always in the context of the individual's personality.

(d) Acceptance of blindness: This variable may possibly be a function of, and accompany each of the other aspects of "the state of blindness" or other personality variables. Its importance as an independent variable is decisive, since for the blind - as for all handicapped persons - adaptation to the defect sets the way of life. Similarly, adaptation affects professional performance ability directly, by determining attitude to the profession (what can be achieved and what is beyond him) by way of its natural connections with personality traits such as security, responsibility, self-acceptance, etc.

Acceptance of blindness has a considerable influence on professional motivation, as on motivation in all other spheres (social, theoretical etc.), and the latter can have an effect on capabilities in the professional field. It is difficult to denote the direction of the hypothesis. Sometimes acceptance of blindness can spur the handicapped "to do his best" despite the

despondency, and at other times it destroys his energy and causes over-aggressiveness which lowers his ability to study and to work.

An important additional aspect of acceptance of blindness is that it is a necessary condition for the ability to learn the performance and communication means characteristic of the blind. These technical aids which greatly ease his daily life (braille, walking with a cane), can only be attained after the internal resistance to them has been overcome.

It is difficult to predict the variegated nature of this variable in the various spheres of life. Consequently, with regard to success an an operator, one must take each case in its own rights. Nonetheless, one can state categorically that the higher the degree of acceptance of blindness that a blind or partially sighted person has achieved, the better his chances of success in the course and at work.

C. Study and performance capabilities.

1. The ability to assimilate the theoretical material.

Our hypothesis is that the probability of the pupil-operator's succeeding varies directly with his ability to assimilate theoretical material. Particularly in the provinces of panel-wiring and integration into the rôle framework* is success

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*It is feasible that there is an optimal level of the ability to learn theoretical material above which the pupil or operator is liable to become bored or to lack satisfaction, with a consequent reduction in performance.

dependent on this variable.

2. The capability of independent thought (creative thinking.

In addition to its being a direct independent variable, this ability, which is affected by personality variables, is liable to have an indirect influence in many fields, and thus to serve as an intervening variable. Our hypothesis is that there is an optimal level of this type of thinking ability. Too high a degree of it is liable to lead to lack of discipline in routine work, lack of interest, and contempt; whereas a very low degree may hamper understanding of the task. A very high degree of capability for theoretical and creative thought may enable success in more advanced courses of automation, such as programming and computer programming.

3. Memory

We assume that a good memory will help the student in the course and at work. The variable has an important function, especially among the blind, who are accustomed to relying on their memory more than sighted people. In the operator's profession memory is of greatest assistance in panel wiring and in the study period in memorising all the material taught.

4. The ability of concrete orientation

a) In space: Among the blind this is expressed in the ability to move about with freedom. We predict that the more

developed it is, the easier it will be for the subject to master the work with the machines. Among sighted operators, this variable does not normally attract attention, but for the blind it is part of the working conditions. According to our hypothesis, the partially blind have an advantage over the blind in this sphere.

b) In object details: By this we mean the ability to deal with materials and objects. It, too, does not stand out as being of primary importance among sighted operators, but for the blind it is of considerable significance and inseparable from their contact with the work material. It is desirable to distinguish two principle aspects: i) Orientation to large object details: greatly aided by orientation in space. ii) Orientation to small object details: The significance of the dichotomy is that the first aspect aids the blind person in the practical work next to the machines. The second aspect is dependent primarily on the sense of touch (tactile) which is a necessary skill for the operator in the location of the holes which comprise the table. According to our hypothesis, the totally blind (especially from childhood) have the advantage over the partially sighted in this field. This is because of their more highly developed sense of touch, and also because the use of the eyes among the partially blind is not sufficient to enable them to deal with small details.

5. Sense of proportion.

We refer to the practical aspects of proportion as expressed

in performance (the intention is not to the comprehension of the significance of concepts or intellectual or analytical processes). For the reasons already enumerated, we assume that this variable is more important for blind operators than for sighted ones. A subject with a good sense of proportion has better chances for success.

6. Imagination

This is necessary for perception of the blind person's environment. Here one must distinguish between the blind from birth, whose perception of the world is idiospecific and dependent on the reality which they themselves have created on the basis of their experiences through the sense of touch, and those who remember the appearance of the environment and whose concepts of objects large and small are similar to those of the sighted. We assume that the ability to imagine reality facilitates perception of the task. Accordingly, our hypothesis is that from this aspect, the non-congenitally blind are at an advantage, and that the older the person when blindness overcame him, the greater the advantage.

7. The ability to communicate.

a) Concrete: An independent variable of help mainly in work next to machines.

b) Abstract: An independent variable of aid in comprehending study material and in the theoretical side of the work (panel wiring). The hypothesis: communication skill varies

directly with the success of the pupil-operator.

8. Motor skills.

a) Speed.

b) Exactness.

c) Coordination - between hands and body,

- between both hands.

This is an important variable for sighted operators as well, but a high degree of coordination may possibly compensate the blind operator for the lack of flexibility and dexterity resulting from his blindness. Once again we predict a direct relation with the dependent variable.

9. Concentration.

In point of fact, this variable should come under personality factors. However, we regard it as an independent variable in this category because of its general significance for all studies and in particular for the theoretical side of work here, and because of its direct contribution to the pupil's success. It fits into the category of "study and performance skills". In other categories it is liable to be an intervening variable. One can say that the greater the ability to concentrate, the better the chances of success in the course and in panel-wiring later during work.

D. Relation to study and performance tasks.

1. Responsibility

This variable can also be classified under personality factors but we place it here because of its special relevance to this category from the point of view of its direct relation to the dependent variable. The more developed the student's sense of responsibility, the higher his chances of success in the rôle.

2. Perseverance

As above.

3. Diligence

As above.

The hypothesis is that perseverance and diligence are quite important independent variables in the study period, and of some significance in the work period - particularly in work integration.

E. Personality variables.

1. Motivation

As an independent variable motivation is liable to reduce or increase the achievement of the operator. However, for the handicapped, it is less important because of the decisive importance of other factors, e.g. the lack of alternative opportunities to

acquire a profession;* the physical disturbances; mental disturbances; auxiliary instruments; means of orientation, etc. Despite this, one must not ignore the importance of this variable. By ignoring other factors one can hypothesise simply that there is a direct relation between the motivation "to be an operator" and the dependent variable - success.

For our purposes it was decided to divide motivation into three sub-variables:

a) Initiative (tendency to independence): Although this variable, which is affected by other personality factors, has on the whole an indirect influence on success, one cannot ignore its existence. It is inseparable from motivation and would appear to be one of its components. However, because of its relevance to success at work, it is necessary to regard it as an independent variable of considerable weight, and for purposes of inspection it is on a par with variables of primary importance. The possibilities of defining it are limited and it can only be measured on an ordinal scale. The main expressions of this variable which influence professional potentialities are as follows: i) Intellectual initiative: This is

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*One must take into consideration that the difficulties in finding alternative professions often result in the opposite to acceptance of the desired situation. In cases of unadaptive personality this is liable to heighten the frustration from the defect, thus indirectly disturbing study and work ability.

expressed in the attitude to the study material in the course and progress in the work of the operator (panel-wiring). ii) Social initiative: This is prominent in staff relations, in the relationship to work supervisors, and influences the integration of the pupil in the course and at work. This sub-variable also affects success in that it is an independent variable for a whole series of intervening variables which in their part are beneficial to success. The reason for this is that the need to integrate into staff life affects the degree of the pupil-operator's security and suitability. iii) Professional initiative: Again we think that here there is an optimal range in which professional initiative will help the operator succeed. Below this range work is liable to be disturbed, and above it the initiative may have negative consequences for the reasons listed in paragraph C 1 and 2.

b) Need achievement: This influences the degree of motivation to succeed both in study and at work. It, too, is an independent variable which is decisive in a system of functional variables in professional education. However, for the blind the constellation of the variables is different because of the intervention of other factors such as the fewer alternatives for employment open to them and

the position of this variable is liable to change. One can suggest that, all other things being equal, pupils with strong need achievement will be more likely to succeed.

c) The position of the profession on the subject's own preference scale: This variable refers to the specific chances of satisfaction as opposed to the danger of perpetual frustration. Obviously, someone who sees the profession of operator as "desirable" and as having high status, will be more likely to assimilate the studies and succeed in the profession.

2. Temperament:

Our intention here is to character factors or even possibly constitutional ones, which exert an influence over and above developmental factors, education and aptitudes. This variable cannot be subdivided on the basis of structured criteria. Not only is it difficult to specify, but it is impossible to define operatively in our framework. Consequently, we cannot measure it quantitatively nor ordinally, but its quite frequent existence should not be ignored. By use of this variable we can explain various phenomena and processes in the advancement of the pupil and operator, but for the abovementioned reasons the explanation is of necessity intuitive.

3. Self confidence:

This variable refers to different phenomena related to the

feeling of confidence as opposed to the feeling of inferiority. Various expressions of this are:-

a) The ability to accept criticism: This is a decisive factor in the ability of the blind operator to correct his mistakes, to make progress in the study period and to accept authority at work. Consequently, the more he is able to accept criticism from another person with ease and without the use of defence mechanisms or without personal slight, the greater will be his ability to master the material and to integrate at work - in comparison to those whose ability to accept criticism is limited. This is important for the pupil particularly in the training period, and to a lesser degree at work.

b) Self-criticism: This variable is of direct importance to the ability to estimate one's work, and influences the ability of the blind operator to comprehend the theoretical material and to accept responsibility at work. The closer self-criticism is to reality and is neither too general nor too destructive as a result of over-stringency, the more it facilitates success.

c) Feelings of inferiority: This variable is very influential for sighted operators and is certainly so for the blind. The reason for this is that their lack of environmental cues, creates in them a greater sensitivity and susceptibility to feelings of inferiority which are liable to cause them to fail, among others, in the professional field. This variable too is

not given to exact measurement. With regard to the hypothesis it is clear that an inferiority complex disturbs equilibrium and interferes with study and work. Description of the degree and nature of the disturbance is a matter for specific individual analysis in each case. The less dominant the feelings of inferiority, the greater the pupil's chances of success.

d) Desire for competition: Among the personality factors this variable is a function of many other independent variables. Yet it also serves as an intervening variable of influence on other personality factors. Nonetheless, we shall discuss it as an independent variable by itself, because of its unique connection with success at work and in study, and also because of its special importance for the blind and its effect on their approach to the profession. In discussing the importance of this variable among the blind, one must note that for them competition exists on two different planes: 1) interpersonal competition within the group, and 2) competition with a sighted person. Like many other variables in the field of personality, this one, too, is difficult to define operatively within our framework. Regarding it as an independent variable, our hypothesis is that a certain level of desire for competition aids professional success. Below this level the pupil falls a victim to defeatism, and above it, he invests too much energy in competition to the detriment of productivity.

4. Social adaptation

One can assess social adaptation on the continuum: good-bad, thus giving it practical significance. One can now state the hypothesis that the better the social adaptation the greater the chances of professional success. This relationship is mediated by many intervening personality variables, by the ability to release intellectual skills, and integration into the framework etc. However, the qualitative components of the variable change its overall nature and one must treat each of them separately. If we see the variable as being measured on the continuum: dependency-cooperation-dominance, we would realise immediately that the connections between dependence and success, cooperation and success, and dominance and success, must be investigated separately. Moreover, each one can have a different effect under different conditions; and in contrast to variables which can be reduced in a similar manner, the separation in this case is essential to our research (particularly for those blind people who tend to develop defence mechanisms in the social sphere). For an example we will take dependence. In its positive expression it is related to the acceptance of authority and is consequently advantageous, but its negative effect merely disturbs the subject. Cooperation is generally a positive indicator, but in its negative expressions it can be interpreted as social isolation

(not in its own rights, but because of its connection with a certain personality context), and social isolation is a negative indicator for professional advancement.

With regard to dominance, we can assume that it is closely connected with the trait of leadership, which in conditions of good ability and by use of suitable means, is a positive indicator.

It is possible that a division into sub-variables was desirable for the purposes of this discussion, but because of the difficulties in the specification of the components, we prefer to speak of social adaptation as a whole and measure it by means of intuitive evaluation on an ordinal scale.

F. Variables dependent on the training period framework*

1. Training methods**

2. Means of orientation (tactilisation)**

3. The curriculum*** - to all intents and purposes, this is an abundance of independent variables connected to:

a) the pedagogical aspects of the curriculum and its dependence on the training methods,

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* Detail is only given about psychological variables.

** With regard to the application of the methods and means for future courses, one must take into consideration that during our course there was not a great deal of confidence in their efficiency, and the experimenting with various machines and methods had a negative influence on progress.

*** This variable was discussed in detail in Report No. 2 as a subject of a special research project.

b) the attitude of the staff to the programme,

c) the attitude of the pupil to the programme.

b) and c), which belong to the psychosocial part of the programme, are not described in detail here, because they are extremely difficult to specify, because they overlap with many variables from other categories and because they are not purely psychosocial. We make use of them for the purpose of analysis of events. It is difficult to state a hypothesis in the standard form and thus we merely mention the existence of the variable, and the nature of its influence is determined by discussion of the individual events of the course.

4. The number of pupils in the course: It is our belief that there is an optimal desirable number for the purposes of presentation of the material. However, apart from this, there is an individual problem of adaptation for each of the scholars, and for each of them a different desirable number. Consequently, we will not present any general hypothesis but note that the variable must be considered and that the nature of its effect and its degree should be investigated in the process of the research during the work of analysis.

5. Study group composition: As an independent variable the composition of the group affects the success of each individual through the intervening variables of social integration, suitability to the group level, etc. An embracing hypothesis

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could consider good or bad composition as aiding or failing the group. However, this has no significance for analysis of each individual, which is what we are interested in with regard to this variable. Our consideration of this variable from the point of view of the formation of a hypothesis, is the same as that described in the previous paragraph.

6. Social relations within the course: This variable affects each individual separately, and every group. At our present stage of research, it can neither be treated quantitatively nor can it be ranked, yet it must be considered in the analysis of events for individuals, or in the summaries of the course. The possibilities of prediction are as above.

7. Professional counselling: As above.

8. Social care during the course: This variable has an indirect influence on those people who require treatment. In the context of this research the variable will be treated as the previous ones.

9. Social services given during the course: The intention is to give financial aid for those who need it, etc. The possibility for hypotheses is as above.

G. Variables dependent on the work period framework.

1. Structure of the IBM machine system: Apart from its direct influence on the blind operator's success at work*, this

* a matter for the technical aspect.

variable also has an indirect effect because of its importance for integration into the work group - the latter being mediated by many intervening variables in the social and personality fields. This effect cannot be analysed nor can it be treated quantitatively and it is difficult to predict the direction of its influence. One can merely prove its existence, and during analysis it must be referred to without there being the possibility of formulating a general formal hypothesis.

2. Work methods: As above.

3. The number of machines: This must be considered because on it is dependent with what and when the blind operator will use a machine.* The supposed effect is as in the two previous paragraphs.

4. The type of machine which the blind operator uses has a direct influence on success, according to our hypothesis. For example: are the machines at his work identical to those with which he studied? The implications for the psychological adjustment are as above.

5. The number of workers in the system: The importance of this is part of the influence of work methods in the social integration of the operator. (See F.4). It is treated as above.

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*a matter for the technical aspect.

6. The supervisory hierarchy has an indirect influence on work methods and the structure of the system. (See 1. above). The operator's integration into the group of workers and supervisors depends on social adaptation, inferiority, etc. A specific hypothesis is almost impossible without discussing each individual on his own merits.

7. Relations with the supervisors: On the one hand this is an independent variable of the individual's success, but on the other hand, is a function of personality factors and serves as an intervening variable. In general, one can assume that a state of good relations helps the blind operator and vice versa, but the analysis should be undertaken with great care.

8. Relations with workmates: As in 7.

9. Working grade of the operator or chances of promotion: This is an independent variable mainly affecting the worker's motivation. Most of all, we regard the chances of advancement at work as an independent variable of success. The hypothesis predicts a direct relation between them. Methodologically, for our purposes, the greater the chances of promotion, the greater the chances of success. However, the connection between this variable and the dependent variable in many cases can be reciprocal.

10. Social conditions in the work period: For treatment

of this variable see 7, 8 and 9 under "Objective variables in the work period".

11. Permanency at work is a decisive factor in the motivation of the operator. Thus, having permanency increases the chances of success.

12. Means of orientation and technical aids in the work period.*

D. DEVELOPMENT OF A SYSTEM OF HYPOTHESIS

We shall now describe the paths taken until we achieved crystallisation of the above system of hypothesis.

1. Selection of the independent variables:

In attempting to translate the various factors into variables, the question of their selection arose. One can indicate an extremely large number of factors, which in some way or other are relevant to the dependent variables, an inspection of which is feasible on the assumption that they might be independent variables. A complete list of relevant variables would probably include every variable that has some connection with the rehabilitation of any type of handicapped person, with professional studies and with integration at work.

In the first stages of the research our task was to choose

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*A matter for the technical side.

from among the entirety of possible variables of which we were intuitively aware, those which we could expect to have a relationship with our goal, which would be strong enough to justify research.

At later stages of the project we applied ourselves to the classification of the degree of relevance of the supposedly independent variables and to the testing of their connection with the dependent variable. Similarly, we concerned ourselves with the crystallisation of methods for the inspection of these connections. This we could not have done from the beginning because at that stage we did not yet have elementary information about the essence of the independent variables. In time we revoked those variables which did not prove sufficiently relevant, and defined, to an increasingly greater degree, the position of other factors (some unpremedidated) as the independent variables.

The stages in the first crystallisation of the system of hypotheses were:-

a) the uncovering and determination of factors which supposedly determined the success of the programme,

b) the translation of factors into variables (mainly independent ones),

c) the distribution of a suitable weight to each variable and category of variables,

d) division of the variables.

The criteria according to which the first selection of the factors was made were:-

a) to what extent the factors had psychological or social signifance,

b) to what extent there appeared to be a connection with the success of the programme from information obtained during the first course,

c) to what extent there appeared to be a connection with the success of the programme from the literature in spheres closely associated with the rehabilitation of the blind, or with the operation of IBM machines.

The system of hypotheses was built, at the beginning, on the basis of our preresearch experience, and of external sources. Within the framework of the project the system became gradually more crystallised.

2. Other sources from the literature

With the transition from the first to the second stage of the research, we started to formulate primary systematic norms about the means of studying the events and processes of the course. At this point we attempted to extract material in an organised fashion from two main sources (apart from our experience in the first course).

i) Plans for the training and rehabilitation of the blind in general.

ii) Course for the training of sighted IBM operators.

We hoped to make use of known material from these fields for the purpose of extracting information for training*. We also hoped to use it for specifying significant factors from the point of view of the research, one of whose concrete aspects was the determination of criteria for the selection of candidates. This was particularly important because of the need to determine the candidates for the experimental courses themselves.

After a short while it became clear that we could rely on these sources only in the most vague fashion.

With regard to the extraction of training material from normal courses for operators, it became obvious that a great deal of it required changing and that we could not transfer it as it was.*

In the province of specification of factors, we relied considerably on the two aforementioned sources, and our first assumptions about the independent variables were derived almost entirely from what was known on rehabilitation of the blind and from courses for training sighted IBM operators. On this basis we were able to evaluate the importance of variables which we had gathered intuitively and to discover additional ones. At

*Details in other reports (1 and 2).

some later stage we will be able to sort the hypothesised variables according to their degree of verification.

The determination of criteria for the selectionof candidates: Here it appeared that there existed means which we could use directly - these were the accepted entrance examinations of institutions that train IBM operators, such as the Centre for Office Automation and the IBM Company. Indeed, we tried to follow these courses and to relate to their requirements for participation, i.e. to make use of psychotechnical tests. This we did either by means of presenting the material as it was (while adapting it to blind subjects), or by using it to extract information about the functions that the tests measured, and by building tests which would measure the same functions in ways more suited to the blind. Most of the tests are achievement ones, e.g. arithmetic, ability tests such as mathematical ability, and various performance tests, and individual tests of the "matrix", "parallel" and National type.

We arrived at this line of thought on the assumption that abilities, which are not specific to the blind and which are advantageous to operators, are identical among sighted and non-sighted populations. However, we encountered certain difficulties which made the very possibility of adaptation of the tests doubtful. The reasons for this were:-

a) There is no agreement between the various institutions that train operators as to which tests serve this purpose. This is because psychotechnic tests (in this as in every other profession) must be adapted to the specific requirements of each country and each automation system. Normally, big systems hold their own courses for operators, and consequently the choice of candidates is made according to the requirements of the system on the assumption that the tests used fulfil their purpose.*

In contrast, in our course we are training operators who will be received into different systems and it is thus impossible that the selection of candidates be made according to the tests of one or another system with specific requirements. In order to clarify this it should be noted that there are systems in which the operator is required both to wire panels and also to plan his work, and the expectations of a new operator are in line with this. On the other hand, there are systems in which the rôle of the operator is mainly technical. In our course we train operators to be able to cope with any type of work which is liable to be demanded of them, including panel wiring.

b) With regard to the traits and abilities on which there is agreement (or partial agreement) and the testing of candidates

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*In point of fact the big systems which, in cooperation with government bodies, train operators are continually working over the data of the tests, and as yet there is no agreement about optimal results even within the systems themselves. Similarly, one should take into account that "the requirements of the systems" are not entirely stable and that they change every few years.

is accomplished on similar sub-tests, it became apparent that these traits were too frequently irrelevant to blind operators, because the study and work patterns for the blind were different from those for the sighted. This is both because there are additional traits and abilities needed for the blind to overcome their lack of sight, and also because the whole system of their perception process is different,* e.g. we noticed that blind people (apart from cases of psychological disturbances) are often capable of more enduring and intensive concentration of thought than sighted people, because they are less influenced by distracting external stimuli. Similarly, in comparison to sighted people, the blind appear to make more use of their memory. They are also required to show a higher level of activity in the theoretical sphere in order to reach the same achievements at work, and often by practice they create for themselves a compensation for their handicap.

It is exactly the specific abilities of the blind that help them master the theoretical and practical material studied and the work performance that we are interested in in our research. This we did not find in the psychotechnic tests for ordinary operators.

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*In this sense a distinction should be made between the blind from birth or early childhood, and those who became blind after adolescence or the partially sighted.

An additional reason for the specific abilities required of our pupils was the difference of our instruction methods as opposed to those used in ordinary courses, e.g. the use of means of orientation during the study period and special instruments during the work period.

c) An additional difficulty is that most of the psychotechnical tests are "paper and pencil" tests based on the use of sight. Translation of these tests to braille and means of orientation deprives them of their value by means of discrimination. In those tests that the speed of performance is measured, it is difficult to assess the time difference required for tactile perception as opposed to perception by means of sight. The test is liable to give a distorted picture, for the blind person needs different abilities to pass it. Consequently, we abandoned the attempts to rely on tests given to sighted candidates as a source of criteria according to which candidates could be directed to our course. We did use some of the abilities measured, such as mathematical thought, analytical ability etc., and attempted to measure them with the help of tests suited to the blind, but only as <u>one</u> of the sources for the discrimination of the traits required of an operator - together with other sources.

3. <u>The difficulties of categorising the independent variables according to the aspects of the research</u>.

An important phenomena of which note must be taken is the fact that change in orientation can alter the relationship to the independent variables from one extreme to another. Every sphere of the research is liable to change in accordance with the viewpoint taken, and this is true for the addition of variables which can alter the system of independent variables and even the connections between them and the dependent variable. It is also true of the reciprocal relations among the variables. There are variables which are clearly independent variables by themselves, but there are others which are connected to different variables in such a way that it is difficult to distinguish whether the connection between them is one of mutual dependence or causality. Similarly, there are variables which are independent ones from a specific aspect of the research, whereas from another aspect they are <u>intervening variables</u>.

The following is an example of the variations in the status of a variable:

<u>The degree of blindness</u> is regarded as an independent variable of primary importance. For the pupils of our course this variable is a predisposition. The use of auxiliary instruments - for those who are not completely blind (magnifying glass,

torch etc.) - is liable to influence the state of vision to a considerable degree at the moment of their use. Thus they are liable to form such an important factor in the pupil's perception of the material that the mere use of them and the quality of the usage are likely to decide the pupil's success in the course and at work. If we wished to study the importance of "auxiliary variables" of this type from the technical aspect, we would have to relate only to those partially sighted whom the instrument could possibly help. No doubt among the latter we would discover the causal relation between the variables.

The auxiliary instrument as a direct reason for success in the course.

Since the difference between success in the course with and without the instrument can be investigated quantitatively (the speed of work, etc.), or at least can be assessed by the supervisors on an ordinal scale, we could test the connection under conditions wherein the rest of the variables could be considered constant. Thus we would have: the auxiliary instrument (X) is an independent variable which clearly influences success in the course (Y). In the defined population, i.e. the population of the partially sighted that require the instrument and that are liable to be aided by it, the connection between the variables will be unambiguous and in one direction. If we were to designate

the population of our pupils with "A", and the population of partially sighted liable to make use of the instrument with "a", then the connection between the variables "auxiliary instrument" and "success in the course" will be

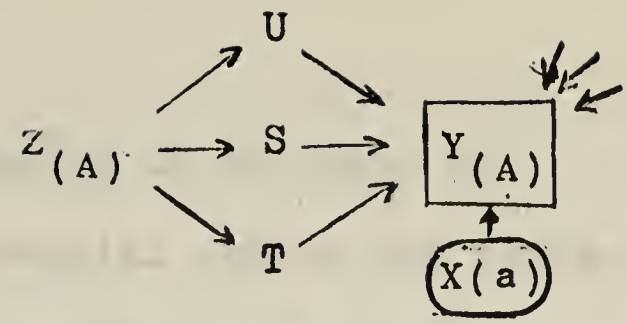
$$X(a) \rightarrow Y(a) \qquad \text{or} \qquad a(X \rightarrow Y)$$

On the other hand, discussion of the value of the instrument from the psychological aspect will alter the status of the variable X because the <u>degree of blindness</u> itself, which is our point of origin for this discussion, does not vary with the application of the instrument and we cannot neglect the existence of intervening variables which result from it, e.g. psychological states or a drop in performance abilities. Thus, from the point of view of the student operator's personality, the immediate use of the auxiliary instrument does not have great significance.

If we wish to relate to the fact that the psychological results of blindness also serve as factors in the success of the course - in their being independent variables for "success" (because of the fact that they are dependent variables of blindness) - we will realise that the status of the variable "auxiliary instrument" in the entirety of the factors has changed and that $X(a) \rightarrow Y(a)$ is not the case and that we must consider different variables in our schema.

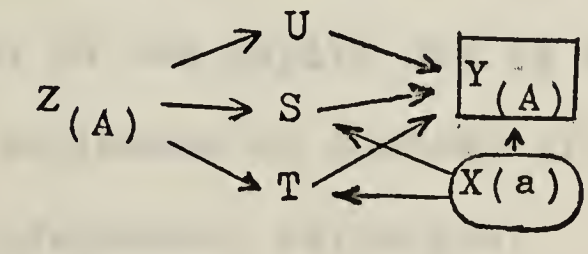
When Z is the degree of blindness the connection between the

variables in the population are:-



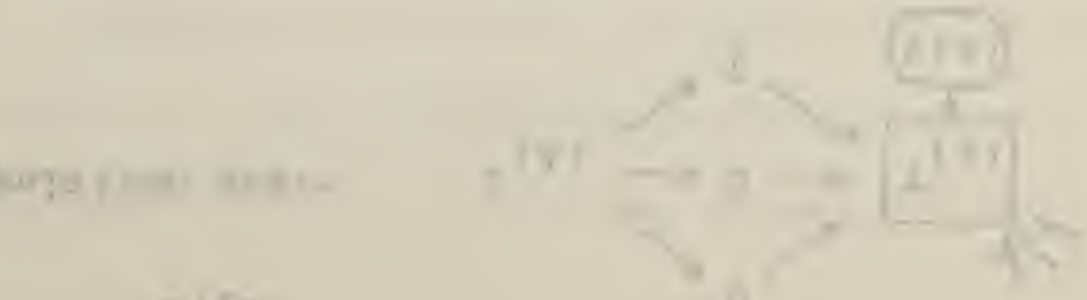
T, S and U can be part of the innumerable intervening factors - psychological factors that are a result of blindness (Z) and on their part a reason for the degree of success in the course and at work.

In practice our field of research is more complicated. If, for example, the use of the auxiliary instrument X affects the partially sighted psychologically, then there is a relation between X ut and the difficulties of isolating the variable are multiplied.



Under these conditions it is even more difficult to determine what the contribution of the auxiliary instrument (X) to the success of the course (Y) is. However, the very existence of the connection X→Y is so clear that one cannot disregard it.

Since our interest in the research is mainly the <u>specification and investigation</u> of variables of a personal and social character - as <u>independent</u> (or intervening) variables in the rehabilitation programme - we are obliged to take the said



connection into consideration, thus causing an entirety of methodological problems. In the psychosocial sphere the variables that can be controlled are few, for the reason that the creation of conditions from this aspect is limited. To the extent that one can influence this type of variable, it is by way of instructing people, directing them with advice, and by treatment, financial aid that will free them from worry during their studies, etc. However, decisive variables such as familial and social situation, origin etc., we cannot manipulate. Thus, we can affect the existing situations alone and cannot create them, in contrast to what is possible in the technical aspect. In terms of this research we conclude that guidance, counselling and social aid given to the pupils can be taken as independent variables in their influence on success of the course, but on the whole not as pure independent variables.

In the psychosocial sphere the majority of the independent variables are a matter for diagnosis and specification, as well as for analysis of the reciprocal influences among them. Few of them can be investigated quantitatively but most of them can be ranked on an ordinal scale. Some of them can be isolated and some not.

We intend to test a number of independent variables of this type and examine which of them can be used to arrive at generalisations which are sufficiently consistent to be relied on in the

planning of future courses, or at least to determine which of the variables behave consistently to the extent (in our experience) that they are worthy of additional inspection or introduction into similar courses.

A final note on the continuity of the project. This report, in dealing with the analysis of the first two courses at this stage has been presented in the past tense. We would like to emphasise that a third course is now being conducted and future courses are also planned.

A P P E N D I X No. 1

The Development of the Psychosociological Aspects of the Research Chronologically, and Functionally and the Achievements

Functions	Chronological Stages	Achievements
The attempt to rehabilitate the blind.	Course I A. For the blind and the partially-sighted	1. The study of training methods. 2. Ascertainment of means of orientation. 3. Intuitive ideas about the necessary personal requirements.
The Beginning of the Formal Research		
1. A rehabilitation programme for the blind. 2. An explorative research into the possibilities of the crystallization of an institutionalized programme for the rehabilitation of the blind as IBM operators.	The graduates of Course I - the work period B. Course II - the training period	1. The improvement and formalization of the existing training methods and means of orientation. 2. The beginning of the normalization of the existing personal criteria and of the selection of the candidates for the course. 3. The institutionalization of the training and work conditions. 4. The construction of a system of hypothese for inspection. 5. The determination of research methods. 6. The cancellation of some of the assumptions.
1. The placement and rehabilitation of the blind as operators within IBM systems. 2. A rehabilitation programme for people with other handicaps.	Course I - the work period Course II - the work period Course III for the blind and other handicapped people - the training period	

A P P E N D I X No. 2

Tabulated Distribution of the Observation Groups

Distribution of the Observation Groups according to Country of Origin

Course 'A'				Course 'B'		
Country of Origin	Total	Males	Females	Total	Males	Females
T o t a l	9	6	3	8	7	1
Israel	-	-	-	3	3	-
Asia	7	6	1	4	4	-
America	1	-	1	-	-	-
Eastern Europe	1	-	1	1	-	1
Western Europe	-	-	-	-	-	-
Others	-	-	-	-	-	-

We have not gone into a more detailed specification of the country of origin because of the nature of the social and cultural structure of the society we consider the above classification as sufficient.

Distribution of Groups according to Age and Year of Birth

Course 'A'				Course 'B'		
Year of Birth	Total	Men	Women	Total	Men	Women
T o t a l	8	7	1	9	5	4
Before 1930	1	1	-	-	-	-
1930 - 1935	-	-	-	2	-	2
1936 - 1940	1	1	-	2	1	1
1941 - 1945	3	3	-	5	4	1
1945 - 1950	3	2	1	-	-	-

Distribution of Groups according to Education

Course 'A'				Course 'B'		
Education	Total	Men	Women	Total	Men	Women
T o t a l	9	5	4	8	7	1
Primary plustrade	-	-	-	1	1	-
partial high School	4	2	2	-	-	-
full high School	4	3	1	6	5	1
higher education not sure	1	-	1	1	1	-
educated abroad	-	-	-	-	-	-

APPENDIX NO. 3

Specimen Questionnaire for Candidate

A. Information on candidate:

Surname: First name: Father's name:

Age: Marital status: Identity card No.:

Place of birth: Year of immigration:

Address:

Remarks:

B. Information on limitations:

Handicap: Blindness ☐ Heart disease ☐ Deaf-mute ☐ Other ☐

which:

causes of the handicap: From what age:

medical diagnosis:

progress of the disease in the past:

prognosis:

Are there other cases of above handicaps in the family?

Were long periods spent in hospital? Yes ☐ No ☐ which ☐

Remarks:

A P P E N D I X No. 4

An Example of a Progress Form for the pupil during the training Period

Progress Form Card-punchers Operators and Programmers

Name of Pupil: _____

Name of instructor: _____

Date	Knowledge of previous material	Knowledge of new material	Perception	Initiative	Speed	Miscel-laneous	Problems connected with handicap	General Problems	Discipline	Remarks	Marks

EXERCISE No. 1

To Become Familiar with Operation of the Oscilloscope

Name of Student _____

Name of Instructor _____

Date	Experiment No.	Section	Time	Partners	Grade

APPENDIX NO. 5

Specimen Questionnaire for the Blind Operator

Section A

Personal data:

Family data:

History of blindness (medical opinion attached):

Education:

Section B

1) How long have you been working in present system?
2) Which machines do you usually work on?
3) Why?

Remarks:

4) Are you satisfied with your work?
5) From which aspects?

   If the open-end answers are not sufficient, the following guidance should be given:

   a) From professional progress:
   b) From everyday work (convenience, difficulties, etc.)
   c) From point of view of interest
   d) From point of view of salary and working conditions

6) How do you get on with your supervisors?
7) How do you get on with your workmates?
8) Do you wish to work here permanently?
9) Are you on the look-out for new work methods?
10) Did you go to the I.B.M. course on your own initiative?
11) Were you equally pleased with the course all the time, or were there fluctuations?
12) If there were fluctuations, in what way were they expressed?
13) What did you do before the course?
14) Which are your best subjects in school?

APPENDIX NO. 5 continued

15) Did this help you during the course?
16) Is this work (I.B.M. operator) greatly different from what you had imagined you would be doing before you had the idea of the course?
17) What had you wanted to do when you were younger?
18) Did you try to train for this?
19) Do you find that there is any connection between the I.B.M. work and those wishes?(if so, what?)
20) If not, do you find your present work a satisfying substitute?
21) In your opinion, what are the qualities that a good operator needs?
22) In your opinion, what are the qualities that a blind operator needs to overcome his limitations?
23) What, in your opinion, are <u>your</u> strong points?
24) Do you occasionally feel limited in comparison with the sighted operator?
25) If so - in what?
26) Would you prefer to work on a small or large system?
27) Why?

APPENDIX NO. 6

Specimen Questionnaire for the Operator's Supervisor

1. First Name & Surname:
2. How long have you been in charge of the blind operator?
3. Has he learned anything new from this work?
4. How many people work in this system?
5. In what sort of conditions does "X" work?
6. What were the conditions like when he was accepted?
7. What are his working conditions when compared with those of other employees?
8. What in your opinion are the qualities of a good operator?
9. Why?
10. What is "X"'s strongest point?
11. In what is "X" most limited?
12. Do you think that he can make progress?
13. Does he show initiative and interest in innovations?
14. Is he responsible in his work (in performance, exactness, discipline)?
15. How does he fit in with his workmates?
16. If you had to grade your employees according to the level of their work on a five-point scale, where would you place "X"?
17. Remarks:

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(1966)

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